# Calculator Usage with the T-E-M-T-T- Problem Solving Method: Its Effect on Student Achievement with Math Story Problems

Master's Project

Submitted to the School of Education
University of Dayton, in Partial Fulfillment
of the Requirements for the Degree
Master of Science in Education

by

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July 8, 1996

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Chapter I

# Introduction

## Background Information

The Ohio Department of Education, as part of its Model Competency-Based Mathematics Program, has taken the position of the National Council of Teachers of Mathematics' (1986) that all elementary students will have ready access to calculators. Also, as of the spring of 1994 in the mathematics section of the SAT, students will now be permitted to use calculators. In the Kettering school district teachers have been given a calculator for each student. It is expected that the students will use the calculators, but teachers haven't been given any direction in how or what to teach with the calculator. In the current math textbook there isn't any support either. No matter at what level we teach math we are being asked to incorporate calculators into our instruction, to teach students both calculator competence and effective ways of using calculators. How do we as teachers make the best use of the calculator?

One of the five general goals as stated in the NCTM's *Curriculum and Evaluation Standards for School Mathematics* (1989) is that all students will become mathematical problem solvers. "The development of each student's ability to solve problems is essential if he or she is to be a productive citizen. We strongly endorse the first recommendation of *An Agenda for Action* (National Council of Teachers of Mathematics 1980): 'Problem solving must be the focus of school mathematics'." p. 6).

Also consistent with the NCTM's *Curriculum and Evaluation Standards for School Mathematics* are the ideas that students use estimation and mental

mathematics in selecting numbers as possible solutions, and to check the reasonableness of results using calculators or computers to carry out the actual computations when appropriate. Students also need to interpret the results with respect to the original problem, and modify incorrect solutions and try again. T-E-M-T-T: trial, error, and modified trial through technology as presented in the article, *Teaching Mathematics with Technology* (Parker & Widmer, 1992), is an approach to calculator use in a problem-solving situation that is consistent with these ideas envisioned in the NCTM's recommendations.

## Statement of Purpose

The purpose of my study is to determine if using a calculator with the T-E-M-T-T approach to problem-solving significantly increases the number of correct solutions on math word story problems versus just allowing the students to use calculators without prior teaching in the use of any particular method or strategy.

## Hypothesis

It is the writer's hypothesis that there will not be a significant increase in the number of correct solutions when students are taught to use the T-E-M-T-T approach to solving story problems.

## Limitations

There may be several limitations that apply to this study. The two classes are

heterogeneously grouped by ability. At the end of each year teachers from the previous year place their students into next year's class according to overall ability in one of three categories high, average, and low. They then balance as best they can the number of each type student the next year's teachers will get. A limitation would be the upsetting of this balance by students entering our school after this initial placement has occurred. Any students that register and enter the school after this initial placement are just assigned to a teacher, by the principal, without regard to academic ability. Also, the balance can be upset by students leaving during the year. A second limitation would be the difference in the number of students in each class, twenty-four students in the treatment group and twenty-one in the control group. A third limitation is the small number of students used in this study. A fourth limitation is the short time frame in which this study takes place. A fifth limitation would be the teaching of the control group in the morning and the treatment group in the afternoon. A sixth limitation would be the extra hour spent with the treatment group working the T-E-M-T-T activities. Any improvement may possibly be do to the increased time this group spent involved in solving problems while working these activities.

Chapter II

## Review of the Literature

Teaching students problem-solving skills and the use of calculators as an aid in the problem-solving process has the backing of the National Council of Mathematics Teachers. In the NCTM's *Curriculum and Evaluation Standards for School Mathematics* (1989), one of the five general goals stated in the NCTM's Standards is that "they (all students) become mathematical problem solvers" (p5). According to the NCTM Standards, "problem solving should be the central focus of the mathematics curriculum" (p23). Students should be taught and encouraged to discover strategies that aid them in their problem solving efforts. "Situations and approaches should build on and extend the mathematical language students are acquiring and help to develop a variety of problem solving strategies and approaches" (p75). "The mathematics curriculum should include numerous and varied experiences with problem solving as a method of inquiry and application so that students can develop and apply a variety of strategies to solve problems, with emphasis on multi-step and non-routine problems" (p75). In the book, *How Children Learn Mathematics* (1989) the authors contend that based on research (Suydam 1982) that a wide variety of problem-solving strategies can and should be taught to students. When problem-solving strategies are specifically taught to students they achieve correct solutions more frequently.

Also recommended in the NCTM Standards is that "appropriate calculators should be available to all students at all times...contrary to the fears of many, the availability of calculators and computers has expanded student's capability of

performing calculations. There is no evidence to suggest that the availability of calculators makes students dependent on them for simple calculations. Students should be able to decide when they need to calculate... they should be able to select and use the most appropriate tool" (p8). "We recognize, however, that access to this technology is no guarantee that any student will become mathematically literate. Calculators and computers...are tools that simplify, but do not accomplish, the work at hand" (p8).

Ever since hand-held calculators have come down enough in price to make them feasible for use in schools, their potential for increasing problem-solving proficiency has been recognized. Research has shown that calculators are good for promoting achievement: their benefit has been shown in reviews by Suydam (1982) and Hembree (1985). Hembree (1986) applied a meta-analysis to the findings of 79 research reports. A main finding of the analysis showed that the use of calculators in testing produces much higher achievement scores than paper-and-pencil efforts both in working exercises and problem solving. This was found to be especially true for low- and high-ability students. A 2-year project carried out by Supai Middle Schools (Bitter, Hatfield) on a population of 600 seventh and eighth grade students showed improvement in problem solving skills when the scores of students who used calculators on the mathematics subsets of the Iowa Basic Skills test were compared with those students who didn't use a calculator. The fact that calculators improve achievement scores has the backing of numerous research studies.

Other benefits of allowing students to use calculators includes the elimination of

much of the drudgery that students experience when doing the computations by hand. Without the drudgery and time consumption of doing computations by hand the student would be able to focus on and analyze the problem solving process (Parker, Widmer 1992, Bitter, Hatfield, 1991, Suydam ,Hembree 1986). With the availability of calculators students can more easily deal with larger numbers and allow consideration of more complex problems. Since burdensome calculations no longer need to be handled with paper and pencil, more problems can be considered. Research also indicates that children tend to use more strategies when they have access to calculators, Wheatley (1980). They can more easily shift their attention from computation to problem solving.

Also suggested by Hembree(1986) and Heid(1988), the student needs to learn how to use a calculator effectively and know when to use it. By itself, the use of a calculator is no guarantee of success in working exercises or in problem solving. Therefore, just making available a calculator for each child would probably not be the best approach for teachers to take when introducing calculators into their math instruction. What is still needed is more research on which approaches or methods are more effective ways in which to teach calculator usage to our students.

As explained in the article, T-E-M-T-T: trial, error, and modified trial through technology is a new mode that students can use to solve problems using calculators and computers. This mode requires students to incorporated many of the ideas and recommendations proposed in the NCTM's Standards. The T-E-M-T-T activities require the use of estimation and mental mathematics to select numbers as possible

solutions using calculators or computers when appropriate to carry out actual computations. Students are then to use estimation and mental mathematics to check for reasonableness of the results, interpreting the results with respect to the original problem. Lastly, students are to modify incorrect solutions and try again. As stated in the NCTM Standards, "students should be encouraged to explore, to guess, and to make and correct errors so that they gain confidence in their ability to solve complex problems" (p5). Also, " estimation can and should be used in conjunction with procedures yielding exact answers to foreshadow any calculation and to judge the reasonableness of results" (p8). The activities presented in the article are designed to encourage the student to explore and to make and correct errors so that they gain confidence in their ability to solve story type problems. The activities, with their immediate feedback, along with suggestions and assistance from the teacher, enabled the students to proceed in a systematic manner rather than through sheer guessing. The calculators and computers help to free the student from tedious computations allowing him/her to concentrate on problem solving.

Chapter III

## Methodology

### Subjects

The subjects of my study were two fifth grade classes, consisting of 45 students, from an elementary school in Kettering, Ohio. Since I teach two separate fifth grade classes in math, I have easy access to two different population samples. Each student was assigned by their fourth grade teacher to one of the two classes so as to maintain a balance in each class of students with similar academic ability and gender.

Control Group. This group consisted of twenty-one students. All of the students were Caucasian. There were eleven girls and ten boys.

Treatment Group. This group consisted of twenty-four students. All of these students were Caucasian consisting of thirteen girls and eleven boys.

Differences in the total amount of students in each class was due to three students from the control group withdrawing from the school system prior to the beginning of this project.

### Setting

School. The school district consists of approximately 8000 students that are housed in nine elementary schools, grades kindergarten through fifth, two middle schools, grades six through eighth, and one high school grades nine through twelve. The writer's building contains 388 students. The fifth grade classes are primarily self-contained with departmentalization for math and science.

Community. The school system is found in a medium sized southwestern city of approximately sixty-thousand people that socioeconomically consist mainly of middle and upper middle class families.

## Data Collection

Construction of the instrument. The writer created each of the five problem solving tests using problems selected from the following resources: Each test consisted of three problems which lent themselves to solution using the strategy currently being taught and practiced. The problem-solving strategies that were taught in the order they were presented to each class were: guess and test, using tables, drawing pictures or diagrams, finding patterns, and multi-stage problems. Space was made available on each test where the student could record intermediate results. For the test that was designed to be solved using tables, tables without any row or column headings were placed on the test. This was done mainly to save the student the time that would be needed to create the tables themselves. Also, creating tables can be a difficult task for some students. Students were told prior to starting the test that they may or may not need to use all of the rows and columns available for each table.

Administration of the instrument. The tests were administered approximately every eight school days over an eight week period. Each of the five tests was administered in a whole group setting, to be given after the students had been introduced to and practiced the strategy that was next to be tested . For the treatment group an extra hour for each strategy was spent working with the T-E-M-T-T activities.

Thirty-six minutes was given to complete each test. Calculators were made available to each child during the test.

The math materials provided by the school district, other supplemental math resources, and activities presented in the article, *Teaching Mathematics with Technology*, were used in carrying out this research. The textbook that was used was the Silver Burdett and Ginn Series (1991). The supplemental materials used were: *The Problem Solver with Calculators* (Creative Publications 1989), *Helping Children Learn Mathematics* (1989), and *Guiding Children's Learning of Mathematics* (1988). Approximately once every 8 school days I taught a different problem solving strategy and practiced solving non-routine problems incorporating the particular strategy being taught. I taught both classes the same way covering the same material. The lesson included an explanation, discussion, and modeling of the problem solving strategy followed by practice solving non-routine problems using that strategy. The particular problems that were used as practice and for the tests came from the text book, as well as the other resources mentioned above. Calculators were available for the students to use when trying to find solutions to the story problems. With the control group, the T-E-M-T-T activities weren't practiced. With the other group, the treatment class, I had them practice solving the problems and working the activities suggested in the article explaining the T-E-M-T-T approach to problem solving. Having only one computer in the room, the activities that involved the use of a spreadsheet were done as a whole group activity with the students suggesting possible values to be entered into the spreadsheet. An ideal and probably more valuable experience would have been for

each child to have their own computer and spreadsheet, where they would be making decisions based on the results of their choices. In total, five tests were given, one for each strategy. Each test consisted of three story problems that lent themselves to being solved using the strategy taught during the previous eight day period. The control class always met in the morning and the treatment class in the afternoon.

Chapter IV

## Results

Baseline data for each class was acquired by averaging their grades for the first two grading periods. The mean scores of both groups were very close with the control group having a mean value of 7.10 compared to a mean value of 7.42 for the treatment group (Appendix A). The writer kept track of the number of story problems each child answered correctly from each test. These scores were recorded into a spreadsheet after each test was scored. The table below shows the results of the eight week study using the T-E-M-T-T problem solving approach. The table consists of the number of students in each group (N), the mean of the number of correct problems for each student ($\overline{X}$), the standard deviation (S), and the coefficient correlation value ($r_s$) of the students' baseline data with their quiz scores. A two tailed t-test was also calculated to determine if the findings were significant.

Means, Standard Deviations, T-Value of Quiz Scores, and the Spearman Rank-Correlation Coefficient for Control and Treatment Groups

| Group | N | $\overline{X}$ | S | $r_s$ |
|---|---|---|---|---|
| Control | 21 | 5.24 | 2.83 | 0.565 (0.368) |
| Treatment | 24 | 5.21 | 2.52 | 0.763 (0.343) |

degrees of freedom = 43; t = 0.961; not significant at .05 level

with n=21 the $r_s$ for the control group was significant at 0.05 level
with n=24 the $r_s$ for the treatment group was significant at 0.05 level

The mean values of the number of correct answers by each group were very close. The control group had a mean score of 5.24 to 5.21 for the treatment group. Using the Spearman Rank-Correlation Coefficient table, both of the coefficient correlation values for each group were significant at the 0.05 level (Appendix D). The control groups coefficient value with n equaling 21 was 0.565 and a value of 0.368 or greater was needed for significance. The treatment groups' coefficient value with n equaling 24 was 0.763 and a value of 0.343 was needed to show significance. The coefficient values for both groups show a linear relationship between each group's baseline score with their quiz scores. A two tailed t-test was performed to determine if there had been a significant increase in the number of problems answered correctly by the treatment group. The level I used to determine if the results were significant was $p < 0.05$. The t-test produced a value of 0.961. For a two tailed test at the 0.05 probability level with a value of 43 for degrees of freedom a t-value of 2.02 was needed to show any significant difference. Since $0.961 < 2.02$, I fail to reject that the null hypothesis is due to chance. Therefore, the null hypothesis was confirmed with the t-test and Spearman Rank and practicing the activities from the T-E-M-T-T article didn't improve the student's chances of correctly solving the non-routine problems. The writer feels that the inability of the treatment group to make significant gains when compared to the control group is probably due to the difficulty most students seem to have in learning problem solving skills and in solving nonroutine problems. Because of the thinking and reasoning skills required to solve many types of nonroutine problems, many students at the fifth grade level aren't yet developmentally ready to solve these

problems. Therefore, you would tend to see very little gain in scores for the time that is spent in modeling the strategies for the students and their practicing of those strategies in problem solving situations.

Chapter V

## Summary, Conclusions, Recommendations

### Summary

The hypothesis for this Master's Project stated that practicing T-E-M-T-T calculator activities would not significantly increase the number of correct responses totaled over five problem-solving tests. Two classes of fifth grade students were used in this research. Both classes were taught five problem-solving strategies over a period of eight weeks. One class also practiced calculator activities designed to help the student practice proceeding in a systematic manner when trying to solve problems rather than through sheer guessing. Approximately every eight days a new problem-solving strategy was introduced and practiced followed in the end by a short test with problems that lent themselves to being solved using the most recently studied strategy. At the end of the eight week period the scores of all five tests of both classes were evaluated using a two tailed t-test. The results of the t-test demonstrated that there was no significant difference between the scores of the two classes.

### Conclusions

Based on the study results, the conclusion of the writer is that practicing the calculator and computer activities presented in the article "*Teaching mathematics with Technology*" will not improve the student's ability to correctly solve non-routine story problems. Although there wasn't a significant gain in the treatment group it must be remembered that this project was conducted over a short period of time. If this study

could have been conducted for the entire year instead of only eight weeks it is possible that there would have been a significant gain.

For students to gain in their problem-solving abilities, teaching problem-solving strategies and incorporating the use of the calculator in doing so must be made an integral part of the math program. Teaching problem-solving strategies should not be viewed as just an area of math that you teach when you have the time and calculators should not only be made available during times when the students are doing math that won't be evaluated.

## Recommendations

As stated in the NCTM standards a major educational goal is that students become mathematical problem solvers able to select and use technology to simplify the work at hand. T-E-M-T-T is an approach that incorporates technology into the problem solving process in a way that is consistent with the NCTM standards. Based on the findings of this research, teachers would probably not want to incorporate practicing the T-E-M-T-T activities into their math programs, but to be certain that practicing the activities presented in the T-E-M-T-T article don't promote an increase in problem-solving achievement, a more involved study for a longer period of time would need to be conducted. Also making available for each student their own time on the spreadsheet where each student can experiment with different values of their own choosing, should be included in any study.

# APPENDICES

## Appendix A

## Mean and Standard Deviation of Baseline Data for Control and Treatment Groups

| Control Group | | Treatment Group | |
|---|---|---|---|
| Student | Baseline Score | Student | Baseline Score |
| 1 | 8 | 1 | 10 |
| 2 | 4 | 2 | 6 |
| 3 | 10 | 3 | 6 |
| 4 | 3 | 4 | 7 |
| 5 | 10 | 5 | 8 |
| 6 | 4 | 6 | 8 |
| 7 | 10 | 7 | 9 |
| 8 | 4 | 8 | 9 |
| 9 | 2 | 9 | 4 |
| 10 | 7 | 10 | 3 |
| 11 | 10 | 11 | 1 |
| 12 | 2 | 12 | 5 |
| 13 | 7 | 13 | 6 |
| 14 | 10 | 14 | 8 |
| 15 | 8 | 15 | 10 |
| 16 | 8 | 16 | 6 |
| 17 | 10 | 17 | 11 |
| 18 | 7 | 18 | 8 |
| 19 | 10 | 19 | 7 |
| 20 | 7 | 20 | 8 |
| 21 | 8 | 21 | 7 |
| | | 22 | 11 |
| | | 23 | 10 |
| | | 24 | 10 |
| Mean | 7.10 | Mean | 7.42 |
| Standard Deviation | 2.83 | Standard Deviation | 2.52 |

Appendix B

Quiz Scores for Each Student in the Control Group

| Student | Guess and Test | Using Tables | Drawing/ Diagram | Finding Patterns | Multi-Stage |
|---|---|---|---|---|---|
| 1 | 1 | 0 | 1 | 0 | 1 |
| 2 | 0 | 0 | 0 | 0 | 0 |
| 3 | 3 | 2 | 1 | 2 | 2 |
| 4 | 1 | 2 | 1 | 0 | 0 |
| 5 | 2 | 1 | 1 | 1 | 0 |
| 6 | 0 | 1 | 1 | 0 | 0 |
| 7 | 2 | 1 | 2 | 2 | 3 |
| 8 | 3 | 2 | 2 | 1 | 0 |
| 9 | 1 | 2 | 0 | 0 | 1 |
| 10 | 0 | 0 | 0 | 0 | 1 |
| 11 | 1 | 1 | 0 | 0 | 2 |
| 12 | 0 | 0 | 0 | 0 | 0 |
| 13 | 2 | 1 | 1 | 1 | 0 |
| 14 | 1 | 0 | 1 | 1 | 2 |
| 15 | 2 | 2 | 1 | 1 | 2 |
| 16 | 2 | 2 | 2 | 1 | 1 |
| 17 | 1 | 3 | 3 | 1 | 1 |
| 18 | 0 | 2 | 1 | 0 | 0 |
| 19 | 2 | 2 | 0 | 1 | 2 |
| 20 | 2 | 2 | 1 | 0 | 2 |
| 21 | 1 | 0 | 2 | 1 | 3 |
| Totals Correct/Quiz | 27 | 26 | 21 | 13 | 23 |

## Appendix C

## Quiz Scores for Each Student in the Treatment Group

| Student | Guess and Test | Using Tables | Drawing/ Diagram | Finding Patterns | Multi-Stage |
|---|---|---|---|---|---|
| 1 | 1 | 2 | 1 | 0 | 1 |
| 2 | 0 | 0 | 2 | 0 | 0 |
| 3 | 0 | 0 | 0 | 0 | 0 |
| 4 | 0 | 1 | 1 | 1 | 1 |
| 5 | 2 | 1 | 1 | 1 | 2 |
| 6 | 1 | 1 | 0 | 0 | 0 |
| 7 | 0 | 2 | 2 | 1 | 2 |
| 8 | 1 | 2 | 0 | 1 | 1 |
| 9 | 1 | 0 | 0 | 0 | 0 |
| 10 | 0 | 0 | 0 | 0 | 0 |
| 11 | 0 | 0 | 1 | 0 | 0 |
| 12 | 1 | 1 | 1 | 1 | 0 |
| 13 | 2 | 1 | 1 | 2 | 0 |
| 14 | 2 | 3 | 1 | 2 | 3 |
| 15 | 3 | 1 | 2 | 1 | 2 |
| 16 | 2 | 0 | 1 | 0 | 1 |
| 17 | 2 | 3 | 1 | 2 | 2 |
| 18 | 0 | 1 | 3 | 1 | 0 |
| 19 | 2 | 2 | 2 | 0 | 1 |
| 20 | 1 | 0 | 1 | 1 | 0 |
| 21 | 0 | 0 | 1 | 2 | 1 |
| 22 | 2 | 2 | 2 | 3 | 2 |
| 23 | 2 | 3 | 0 | 2 | 1 |
| 24 | 2 | 2 | 2 | 1 | 2 |
| Totals Correct/Quiz | 27 | 28 | 26 | 22 | 22 |

## Appendix D

### Correlation Coefficient of Baseline Data and Quiz Scores for Control and Treatment Groups

| Control Group | | | Treatment Group | | |
|---|---|---|---|---|---|
| Students | Baseline Score | Total Problems Correct | Students | Baseline Score | Total Problems Correct |
| 1 | 8 | 3 | 1 | 10 | 5 |
| 2 | 4 | 0 | 2 | 6 | 2 |
| 3 | 10 | 10 | 3 | 6 | 0 |
| 4 | 3 | 4 | 4 | 7 | 4 |
| 5 | 10 | 5 | 5 | 8 | 7 |
| 6 | 3 | 2 | 6 | 8 | 2 |
| 7 | 10 | 10 | 7 | 9 | 7 |
| 8 | 4 | 8 | 8 | 9 | 5 |
| 9 | 2 | 4 | 9 | 4 | 1 |
| 10 | 7 | 1 | 10 | 3 | 0 |
| 11 | 10 | 4 | 11 | 1 | 1 |
| 12 | 2 | 0 | 12 | 5 | 4 |
| 13 | 7 | 5 | 13 | 6 | 6 |
| 14 | 10 | 5 | 14 | 8 | 11 |
| 15 | 8 | 8 | 15 | 10 | 9 |
| 16 | 8 | 8 | 16 | 6 | 4 |
| 17 | 9 | 9 | 17 | 11 | 10 |
| 18 | 7 | 3 | 18 | 8 | 5 |
| 19 | 10 | 7 | 19 | 7 | 7 |
| 20 | 7 | 7 | 20 | 8 | 3 |
| 21 | 8 | 7 | 21 | 7 | 4 |
| | | | 22 | 11 | 11 |
| | Correlation Coefficient | 0.565 | 23 | 10 | 8 |
| | | | 24 | 10 | 9 |
| | | | | Correlation Coefficient | 0.763 |

## Appendix E

### Means, Standard Deviations, and T-Value of Quiz Scores for Control and Treatment Groups

| Control Group | | Treatment Group | |
|---|---|---|---|
| Students | Total Problems Correct | Students | Total Problems Correct |
| 1 | 3 | 1 | 5 |
| 2 | 0 | 2 | 2 |
| 3 | 10 | 3 | 0 |
| 4 | 4 | 4 | 4 |
| 5 | 5 | 5 | 7 |
| 6 | 2 | 6 | 2 |
| 7 | 10 | 7 | 7 |
| 8 | 8 | 8 | 5 |
| 9 | 4 | 9 | 1 |
| 10 | 1 | 10 | 0 |
| 11 | 4 | 11 | 1 |
| 12 | 0 | 12 | 4 |
| 13 | 5 | 13 | 6 |
| 14 | 5 | 14 | 11 |
| 15 | 8 | 15 | 9 |
| 16 | 8 | 16 | 4 |
| 17 | 9 | 17 | 10 |
| 18 | 3 | 18 | 5 |
| 19 | 7 | 19 | 7 |
| 20 | 7 | 20 | 3 |
| 21 | 7 | 21 | 4 |
| | | 22 | 11 |
| | | 23 | 8 |
| | | 24 | 9 |
| Mean | 5.24 | | 5.21 |
| Standard Deviation | 2.83 | | 2.52 |
| t-test value | 0.9613 | | |

Appendix F

Guess and Test

Name_____

1. Jill has $.67. She has some nickels and some pennies for a total of 15 coins. How many of each of coin does Jill have?

number of nickels_____ number of pennies_____

2. Bill and Frank have 69 marbles altogether. Bill has 17 more marbles than Frank. How many marbles does Bill have? (***Hint:*** The answer isn't 52 marbles.)

(***Hint***)

Bill's marbles + Frank's marbles = 69 marbles

Answer_____

3. At Snow Hill there were 47 people waiting to ride the bobsleds. Some of the bobsleds held 5 people and some held 4 people. Only full sleds went down the hill. All 47 people went down in 10 sleds. How many sleds of each kind were used?

4 person sleds _____ 5 person sleds_____

Appendix G

Making/Using Tables

Name _____

1. A movie that costs $5.50 is shown at 3 different times on a Saturday. There are 3 times as many people at the first show than there are at the second showing. There are 9 times as many people at the second showing than are at the third showing. At the third showing there are 55 people. On this Saturday how much money is collected by the people at the movie theater?

Answer_____

| Which Showing | Number of people | Money made |
|---|---|---|
| | | |
| | | |
| | | |

2. You and your sister get paid your allowance at the end of the week. You agree to combine your money to buy a dog. Since you make more money than your sister, for the first 3 weeks you are going to save $8.50 while your sister is going to save $5.75 a week. Since your sister gets a raise in 3 weeks, starting the fourth week she is going to put another $1.50 into her savings to help pay for the dog. The dog costs $90. How many weeks will it take you and your sister to save up the money to purchase the dog?

Answer_____

| | | | | |
|---|---|---|---|---|
| | | | | |
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| | | | | |
| | | | | |
| | | | | |

3. You need 17 pounds of fertilizer for a science fair project to use with an experiment with plants. The fertilizer comes in either 3 pound bags that cost $2.29 each or 5pound bags that cost $3.25 each. How many bags of each size do you buy to obtain at least 17 pounds for the lowest cost?

Answer: ____ 3 pound bags ____ 5 pound bags

| | | | | |
|---|---|---|---|---|
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
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| | | | | |

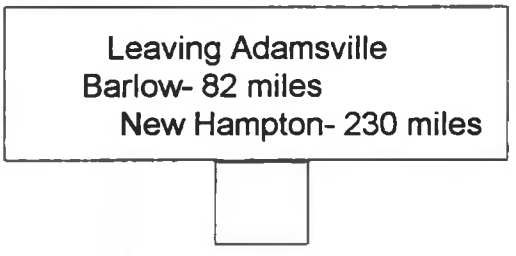
Appendix H

Making a Picture/Diagram

Name_____

1. Robin, a daddy longlegs spider, is the pet of the fifth grade class. Robin likes to walk around the edge of the ceiling, where the ceiling meets the walls. The ceiling is 24 feet wide by 38 feet long. Today, Robin starts out in the middle of a 24-foot edge of the ceiling. She crawls around the edge of the ceiling for a distance of 980 feet. She stops. She crawls on for 12 more feet. Where on the ceiling is Robin?

2. This road sign appears at the city limits of Adamsville:




How many miles must you travel from Adamsville until you are halfway between Barlow and New Hampton?

3. Loch Florissa, a sea monster, has been swimming off the coast of Floraborda. Loch Florissa swims with its body partly in and partly out-of-the water, in a definite pattern. The head is out of the water, the next part is in the water, the next part is out of the water, and so on. There are four out-of-water parts, including the head and the tail. The head is 642 inches long. Each out-of-water part is 78 inches shorter than the previous out-of-water part. Each in-the-water part of the body is 116 inches long. How many feet long is Loch Florissa?

Appendix I

Finding Patterns

Name_____

1. A store sells 7 different flavors of ice cream: vanilla, chocolate, strawberry, butter pecan, raspberry, rocky road, and chocolate chip. How many 2 dip cones of ice cream with 2 different flavors can be created using these 7 flavors of ice cream?

_____

2. How long would it take to spread a rumor in a town of 90,000 people if each person who heard the rumor told it to 3 new people every 15 minutes?

_____

3. There are long weeks, but no months, on the Squeakyshoes calendar. On planet Squeakyshoes, the year is 365 days long, and the year is divided into weeks. The first day of the week is named A-day, the second day of the week is named B-day, and so on to the last day of the week Z-day. The Squeakyshoes love H-days. Every H-day is a holiday and all the Squeakyshoes celebrate. Day 1 of the year 2005 falls on H-day. How many holidays will the Squeakyshoes have in the year 2005?

_____

Appendix J

Multi-Stage Problems

Name_____

1. Jean launches model rockets. When she uses type A engines, the rocket usually reaches a height of 200 feet. She would like to try a type B engine. A rocket usually goes about 2.6 times as high with a type B engine than a type A engine. About how many feet higher should the rocket with a type B engine go?

_____

2. The Rocketry Club needs a field for launching model rockets. For a type B engine, the field must be at least 180 feet wide and have a length of 1.3 timed the width. How much fencing is needed to enclose the field?

_____

3. An inch of rain is considered equivalent to a foot of snow. Last month there were snowstorms in which 6 inches, 12 inches, 5 inches, 7 inches, and 6 inches of snow fell. If the snow had been rain, how much rain would have fallen?

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